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DRAFT BIOVENTING TEST WORK PLAN FOR FIRE TRAINING PIT 1 AND FIRE TRAINING PIT 4 AND OIL/WATER SEPARATOR (FT-002) PLATTSBURGH AFB, NEW YORK

Prepared For

Air Force Center for Environmental Excellence
Brooks AFB, Texas

and

380th Civil Engineering Squadron and
Environmental Management Branch
Plattsburgh AFB, New York

ES
ENGINEERING-SCIENCE, INC.

1700 BROADWAY, SUITE 900
DENVER, COLORADO 80290

ES ENGINEERING-SCIENCE

AQM01-03-0416

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DRAFT BIOVENTING TEST WORK PLAN FOR FIRE TRAINING PIT 1 AND FIRE TRAINING PIT 4 AND OIL/WATER SEPARATOR (FT-002) PLATTSBURGH AFB, NEW YORK

Prepared for

Air Force Center for Environmental Excellence
Brooks AFB, Texas

and

380th Civil Engineering Squadron and
Environmental Management Branch
Plattsburgh AFB, New York

by

Engineering-Science, Inc
1700 Broadway, Suite 900
Denver, Colorado

February 1993

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DRAFT BIOVENTING TEST WORK PLAN FOR

FIRE TRAINING PIT 1

AND

FIRE TRAINING PIT 4 AND OIL/WATER SEPARATOR

(FIRE TRAINING AREA - 002)

PLATTSBURGH AFB, NEW YORK

1.0 INTRODUCTION

This test work plan presents the scope of an *in situ* bioventing pilot test for treatment of fuel contaminated soils within Fire Training Area - 002 (FT-002) at Fire Training Pit (FTP) 1 and FTP 4 (including the oil/water separator) on Plattsburgh AFB, NY. The pilot test has three primary objectives: 1) to assess the potential for supplying oxygen throughout the contaminated soil depth, 2) to determine the rate at which indigenous microorganisms will degrade fuel when stimulated by oxygen rich soil gas, 3) to evaluate the potential for sustaining these rates of biodegradation until fuel contamination is remediated below regulatory standards.

Pilot testing will consist of two phases, and initial air permeability and *in situ* respiration test which will take place in March or April of 1993, and an extended one year pilot test which will be used to determine the potential for bioventing remediation using natural nutrient levels. Testing will also provide an estimate of cold weather biodegradation rates. The initial and extended pilot test will serve as treatability studies under the CERCLA feasibility study process. If bioventing proves to be feasible at this site, pilot test data may be used to design a full scale remediation system and to estimate the time required for site cleanup.

The initial test will involve injection at a vent well with a regenerative blower to produce a radius of influence of at least 60 feet. *In situ* rates of fuel biodegradation and soil gas permeability will be determined during this short term test and a decision on how best to proceed with extended testing will be made with regulatory concurrence.

Additional background information on the development and recent success of the bioventing technology is found in the document entitled *Test Plan and Technical Protocol For A Field Treatability Test For Bioventing* (Hinchee, et al. 1992). This protocol document is a supplement to the site-specific work plan, and it will also serve as the primary reference for pilot test vent well designs and detailed test objectives and procedures. Unless otherwise noted, test procedures outlined in the

protocol document will be used during the pilot tests at FTP 1 and FTP 4/ oil/water separator.

2.0 SITE DESCRIPTION

2.1 Fire Training Pit Area - 002

2.1.1 Site Location and History

Fire Training Area - 002 (FT-002) is located approximately 500 feet west of the runway, approximately 500 feet east of the Plattsburgh AFB boundary, south of landfill LF-022 and north of LF-023. The site is located on a land surface which slopes gently toward the Saranac and Salmon Rivers which are located approximately 1.9 miles east of the site (Figure 2.1). Four bermed pits are located at the site ranging from approximately 60 to 160 feet in diameter. The majority of the soil contamination on the site is beneath and adjacent to Pit 1, the smaller of these bermed pits. Figure 2.2 shows the location of the pits in relation to Perimeter Road.

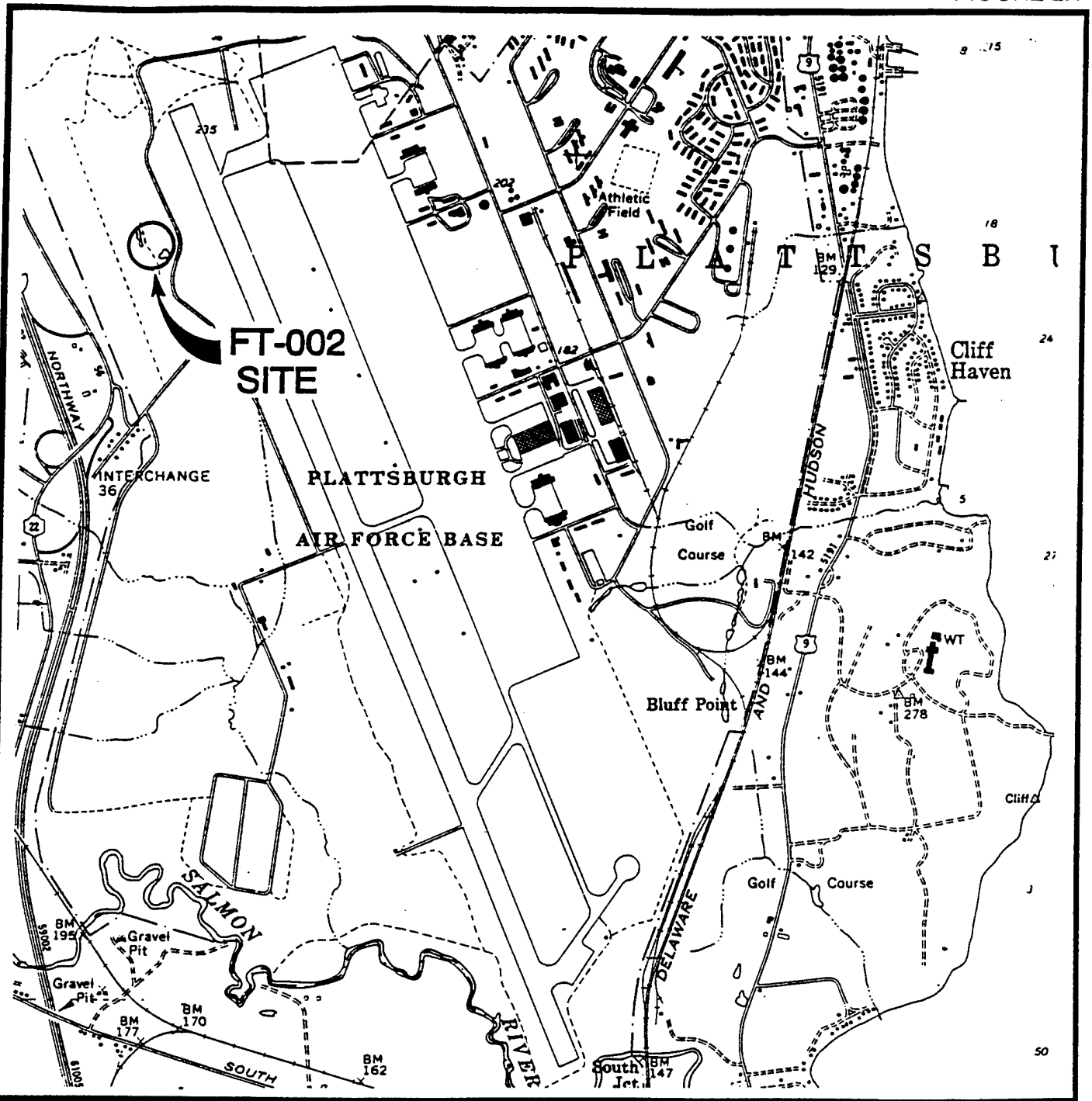
Fire training exercises were conducted at this site from the middle to late 1950s and continued until the site was permanently closed on May 22, 1989. Typically, the bottom of the pit was saturated with water and then filled with a layer of jet fuel and then ignited. Fire fighters would practice extinguishing the flames which generally surrounded a mock metal aircraft in the pit. Unburned fuel soaked into the ground creating the contaminated soil column now found beneath the pit. In 1980, cement-stabilized soil liners were added to Pits 2 and 3 which were active at that time; Pits 1 and 4 had been deactivated. Prior to strict environmental regulations, solvents and other chemicals were sometimes mixed with the fuel and placed in the pit for burning. Some fuel and noncombustible fluids seeped into the soil beneath the unlined pits or leaked through cracks in the lined pits. After years of training activities at the site, the soil column beneath each pit has become contmainated with fuel-related compounds and solvents. Another potential source is the oil/water separator that received drainage from Pits 2 and 3. The hydrocarbon contamination from these sources is the target for bioventing treatment at this site.

2.1.2 Site Geology

Because the bioventing technology is applied to the unsaturated soils, this section will primarily address soils above the shallow aquifer. Soils at this site consist of Pleistocene marine deposits which results in uniform layers of sand and clay overlying till and carbonate bedrock. Ground water is encountered within the sand in the area of the pits at a depth of approximately 29 to 43 feet and generally flows southeasterly toward Salmon River.

Due to the homogeneous nature of the sand, the permeability of soils to air flow should remain relatively constant across the site. Effective bioventing on this site is likely. Engineering-Science has completed successful bioventing projects within similar geological deposits and we are confident that oxygen can be distributed in these soils. Initial testing has also been completed in adjacent Pits 2 and 3 and results have indicated excellent distribution of oxygen and biodegradation rates up

FIGURE 2.1



BASE MAP : U.S.G.S. 7.5 TOPOGRAPHIC MAP
(QUADRANGLE)PLATTSBURGH, NEW YORK

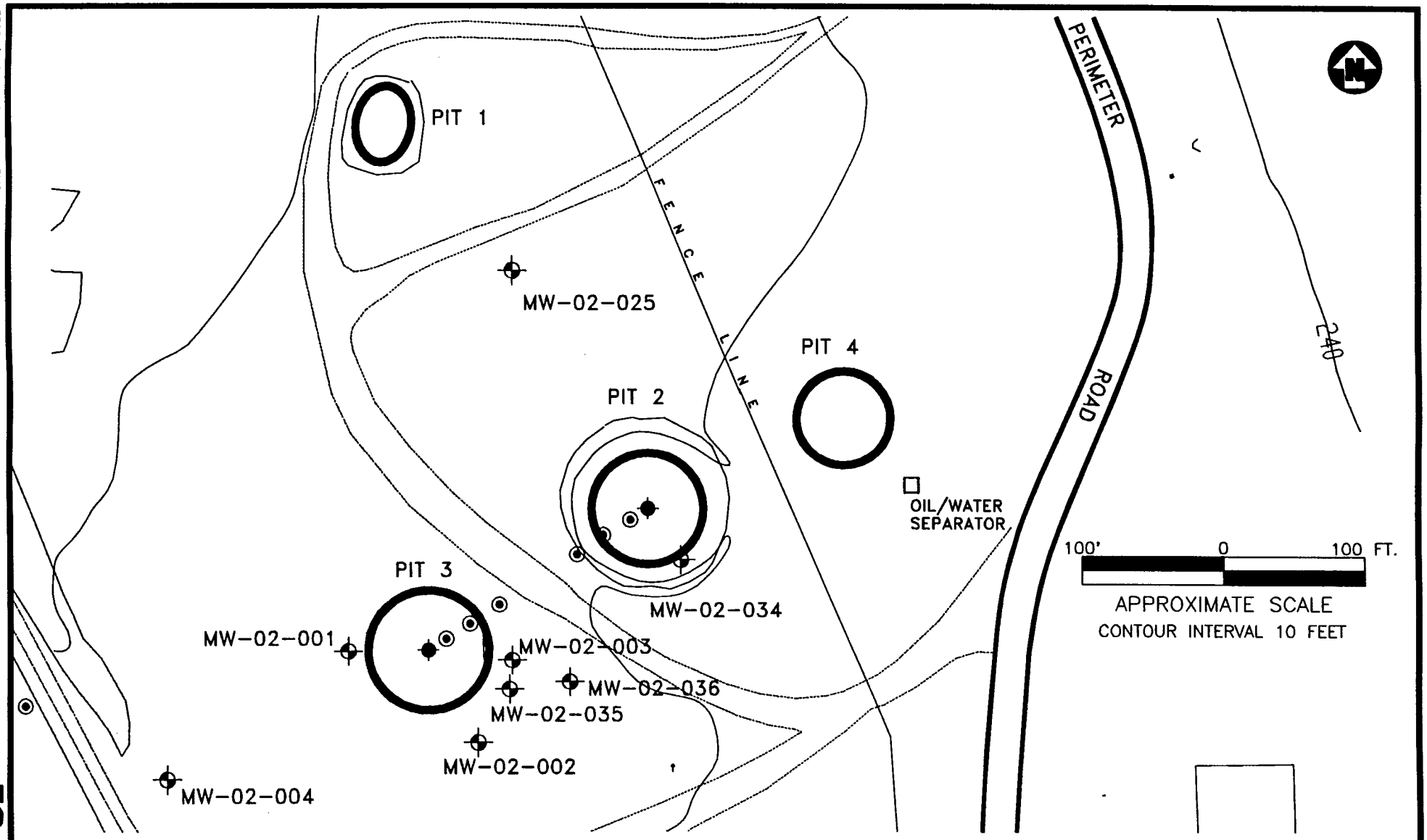
LATITUDE : 44° 37' 30" N
LONGITUDE : 73° 30' 00" W

SCALE
0 2000 4000 FT.

ENGINEERING-SCIENCE

SITE LOCATION MAP

PLATTSBURGH AFB
Plattsburgh, New York



SITE PLAN

PLATTSBURGH AFB
Plattsburgh, New York

FIGURE 2.2

ES ENGINEERING-SCIENCE

to 5,400 mg total petroleum hydrocarbon (TPH) per kg soil per year. To monitor the bioventing test, soil vapor monitoring points will be positioned in three locations adjacent to the vent wells installed in Pits 1 and 4. Three depths at each point will be monitored to study the subsurface oxygen distribution and to measure *in situ* respiration rates.

2.1.3 Site Contaminants

Pit 1

The primary contaminants in the Pit 1 source area are fuel residuals which have migrated to a depth of approximately 43 feet where the maximum depth to groundwater is encountered. Figure 2.3 shows a typical cross-section across the center of the site (ABB Environmental Services, 1992). Free product has been observed in monitoring wells in the source area and on the site near Pit 1. A maximum petroleum hydrocarbon (PHC) concentration of 12,000 mg/kg has been detected in the surface soils sampled at a depth between 2 and 4 feet below below ground surface (bgs). Samples collected inside the pit source area and above the water table showed PHC concentrations from 1,800 to 12,000 mg/kg. Volatile organic compounds benzene, toluene, ethylbenzene, and total xylenes (BTEX) were detected in the soils above the water table along with trace amounts of chlorinated solvents such as trichloroethene and dichloroethene compounds (ABB Environmental Services, 1992).

Pit 4 and Oil/Water Separator

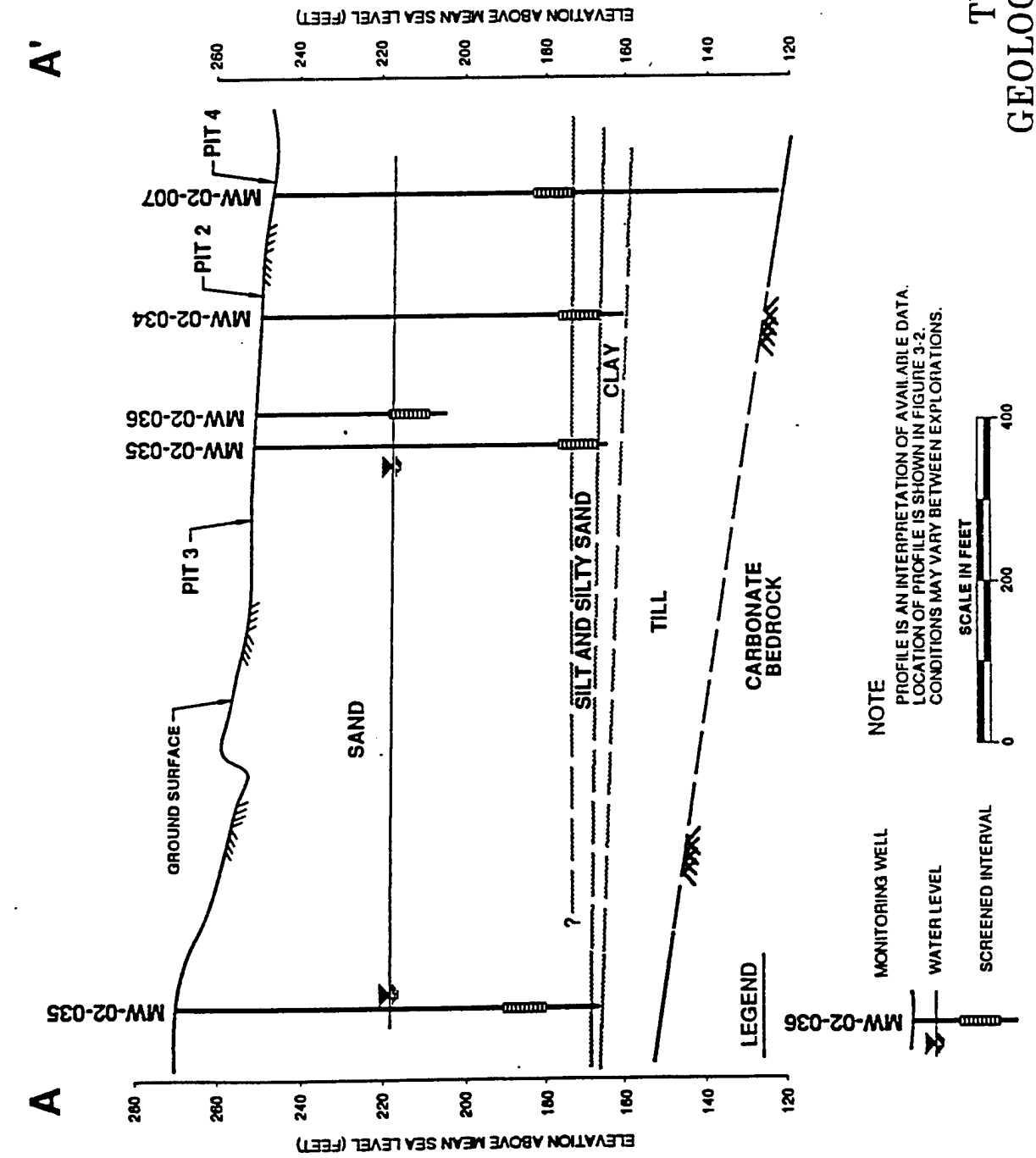
The primary contaminants in the Pit 4 source area are fuel residuals which have migrated to a depth of approximately 35 feet where the maximum depth to groundwater is encountered. Figure 2.3 shows a typical cross-section across the center of the site (ABB Environmental Services, 1992). Free product has been observed in monitoring wells downgradient of Pit 4 near the oil/water separator. A maximum PHC concentration of 4,500 mg/kg has been detected in the surface soils sampled at a depth between 2 and 4 feet bgs. Samples collected inside the pit source area and above the water table showed PHC concentrations from 450 to 7,250 mg/kg. Trace amounts of volatile organic compounds ethylbenzene and xylenes were also detected in the soils above the water table. PHC concentrations in a boring next to the oil/water separator were below the detection limit except at the water table where they exceeded 20,000 mg/kg. (ABB Environmental Services, 1992).

3.0 PILOT TEST ACTIVITIES

3.1 Introduction

The purpose of this section is to describe the work that will be performed by Engineering-Science, Inc. (ES) at FTPs 1 and 4. Activities that will be performed at each site include siting and construction of a central vent well (VW) and three vapor monitoring points (VMPs); an *in situ* respiration test; an air permeability test; and the installation of an extended bioventing pilot test system. Soil and soil gas sampling procedures and blower configuration that will be used to inject air

TYPICAL GEOLOGIC PROFILE
PLATTSBURGH AFB
Plattsburgh, New York



(FROM ABB ENVIRONMENTAL SERVICES, INC., 1992)

(oxygen) into contaminated soils are also discussed in this section. In an effort to be as cost effective as possible, a single VW will be completed to the depth of lowest seasonal groundwater at each site. Pilot test activities will be confined to unsaturated soils remediation; no dewatering will take place during the pilot tests. Existing monitoring wells will not be used as primary air injection or extraction wells. However, monitoring wells which have a portion of their screened interval above the water table may be used as VMPs or to measure the composition of background soil gas. Exisiting VMPs in FTP 2 may also be monitored during air permeability testing associated with the Pit 4 area.

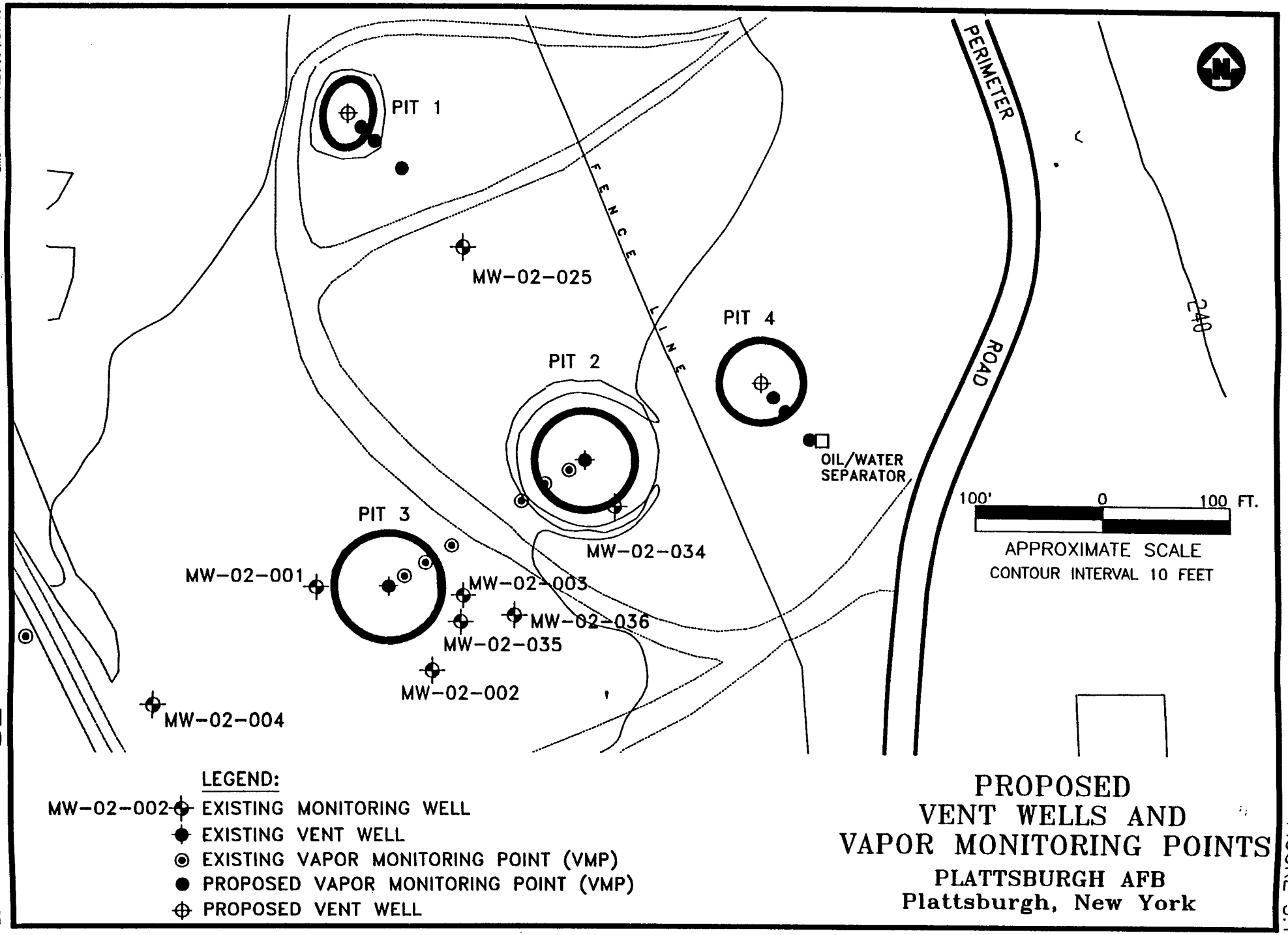
3.2 Well Siting and Construction

3.2.1. Well Siting and Construction for Pit 1

A general description of criteria for siting a single central VW and associated VMPs in the pit are included in the attached protocol document. Figure 3.1 illustrates the proposed location of the central VW and VMPs at the pit. The final location of the VW may vary slightly from the proposed location if significant fuel contamination is not observed in the boring for the central VW. Based on site investigation data, the VW will be located just off the center of the bermed fire training pit. The area is expected to have an average TPH concentration exceeding 5,000 mg/kg . Soils in this area are expected to be oxygen depleted (< 2%) and increased biological activity should be stimulated by oxygen-rich soil gas ventilation during full-scale operations.

Due to the relatively deep depth of contamination at this site and the potential for moderate permeability soils, the radius of venting influence around the central air injection well in the pit is expected to exceed 60 feet. Three VMPs will be located within a 60-foot radius of the central VW. Background monitoring for this test will conducted at the background vapor monitoring point located approximately 600 feet west of Pit 4. The background well will be used to measure background levels of oxygen and carbon dioxide and to determine if natural carbon sources are contributing to oxygen uptake during the *in situ* respiration test.

The VW will be constructed of 4-inch ID Schedule 40 PVC, with a 35 foot interval of 0.04 slotted screen set between 10 and 45 feet bgs (the deepest seasonal groundwater elevation). Flush-threaded PVC casing and screen will be used with no organic solvents or glues. The filter pack will be clean, well-rounded silica sand with a 6-9 grain size and will be placed in the annular space of the screened interval. A 7-foot layer of bentonite will be placed directly over the filter pack. The first foot of bentonite will consist of granular bentonite and/or pellets hydrated in place with potable water. This layer of granular or pellets will prevent the addition of bentonite slurry from saturating the filter pack. The remaining 6 feet of bentonite will be fully hydrated and mixed above ground and the slurry tremied into the annular space to produce an air tight seal above the screened interval. A complete seal is critical to prevent injected air from short-circuiting to the surface during the bioventing test. Silica sand and cement grout will placed over the slurry to the surface. Figure 3.2 illustrates the proposed central VW construction details for this site.



PROPOSED VENT WELLS AND VAPOR MONITORING POINTS

PLATTSBURGH AFB
Plattsburgh, New York

FIGURE 3.1

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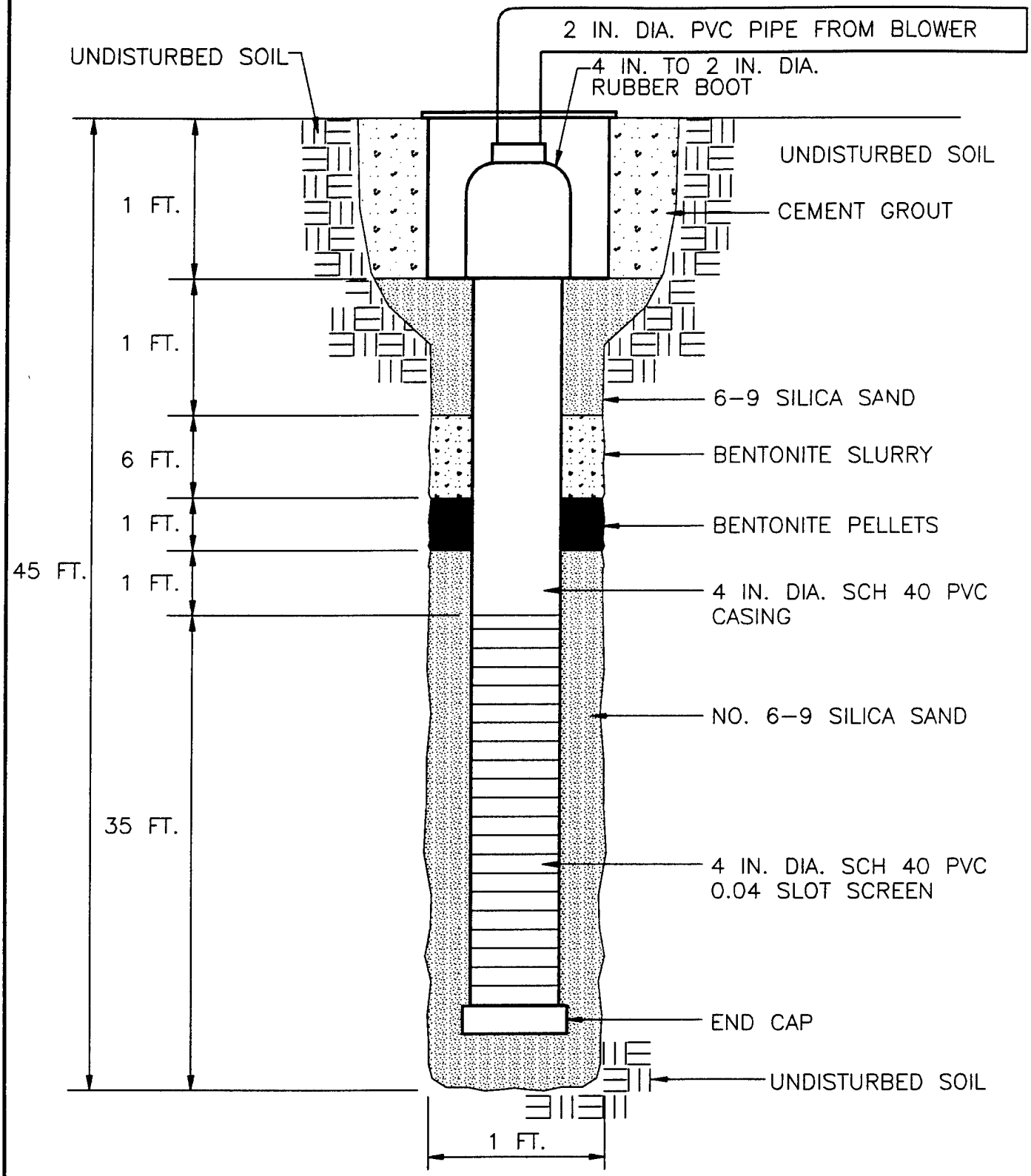
FIGURE 3.2



NOT TO SCALE

FIRE TRAINING AREA
(FT - 002)
INJECTION VENT WELL
CONSTRUCTION DETAIL
PLATTSBURGH AFB, NEW YORK

ENGINEERING-SCIENCE, INC.
Syracuse, New York

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A typical multi-depth VMP installation for this site is shown in Figure 3.3. Soil gas oxygen and carbon dioxide concentrations will be monitored at depth intervals of approximately 10 - 12 feet, 25 - 27 and 40 - 42 feet at each location (the deepest monitoring point will be set at approximately 3 feet above the deepest seasonal groundwater elevation). Multi-depth monitoring will confirm that the entire soil profile is receiving oxygen and be used to measure fuel biodegradation rates at all depths. The annular space between these three monitoring points will be sealed with bentonite to isolate the monitoring intervals. As with the central vent well, several inches of granular bentonite or pellets will be used to shield the filter pack from rapid infiltration of bentonite slurry additions. Additional details on VW and monitoring point construction are found in Section 4 of the protocol document.

3.2.2 Well Siting and Construction for Pit 4

The methods used for well siting and construction for Pit 4 will be identical to those used for Pit 1 with a few exceptions. The vent well will be screened from 10 to 35 feet bgs, and the monitoring point depth intervals will be approximately 8 - 10 feet, 19 - 21 feet, and 30 - 32 feet.

3.3 Handling of Drill Cuttings

Drill cuttings from all borings will be left at each location in accordance with the current procedures for ongoing remedial investigations.

3.4 Soil and Soil Gas Sampling

3.4.1 Soil Sampling

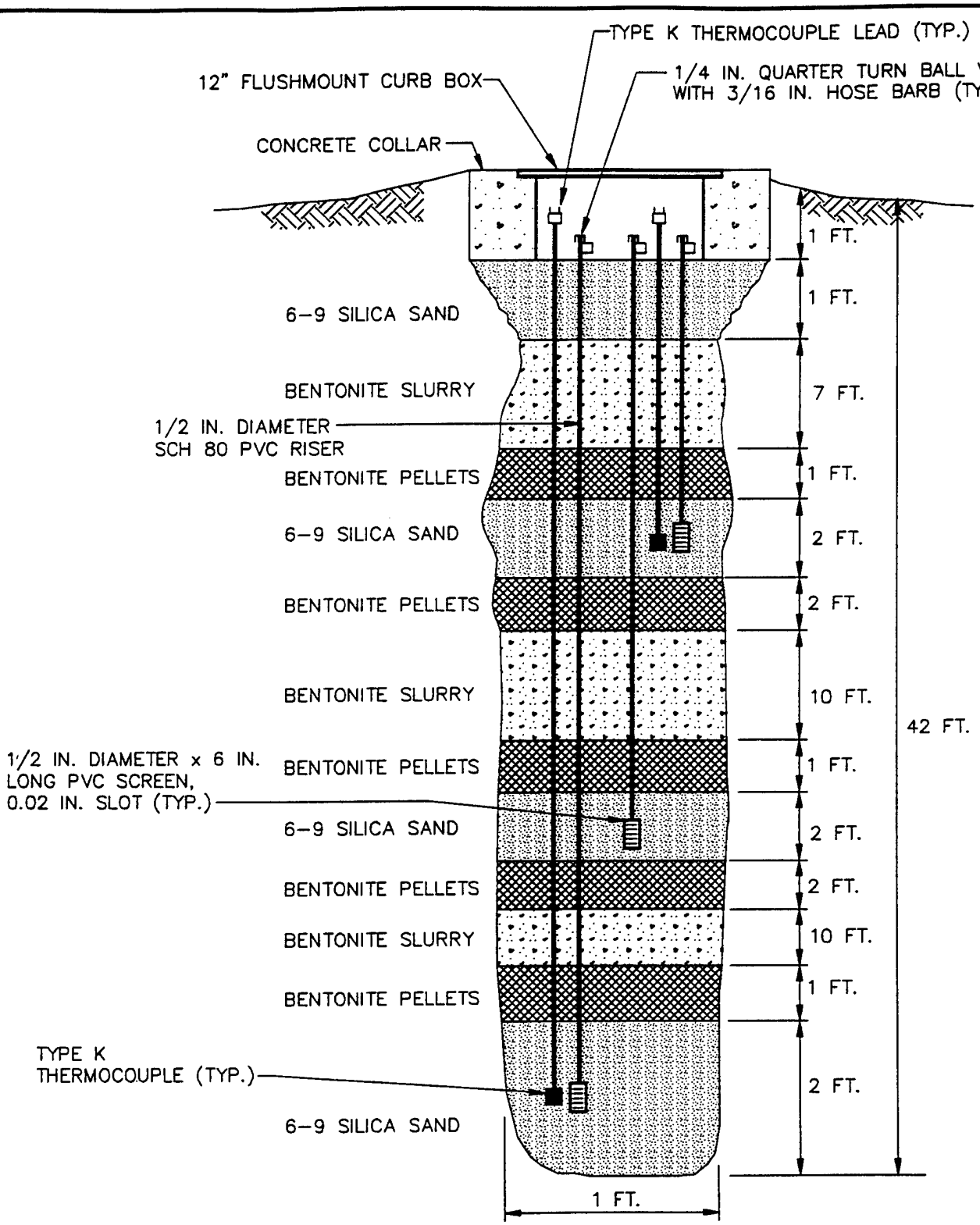
Three soil samples will be collected from each pilot test area during the installation of the VWs and VMPs. One sample will be collected from the most contaminated interval of the central VW boring and one sample will be collected from the interval of highest apparent contamination in each of the borings for two VMPs at each site. Soil samples will be analyzed for TPH, BTEX, soil moisture, pH, particle sizing, alkalinity, total iron and nutrients.

Samples will be collected using a split-spoon sampler containing brass tube liners. A photoionization detector or total hydrocarbon vapor analyzer (see protocol Section 4.5.2) will be used to insure that breathing zone levels of volatiles do not exceed 1 ppm during drilling and to screen split spoon samples for intervals of high fuel contamination. Soil samples collected in the brass tubes will be immediately trimmed and aluminum foil and a plastic cap placed over the ends. Soil samples will be labelled following the nomenclature specified in the protocol document(Section 5.5), wrapped in plastic, and placed in an ice chest for shipment. A chain of custody form will be filled out and the ice chest shipped to the ES laboratory in Berkeley, California, for analysis. This laboratory has been audited by the U.S. Air Force and meets all quality assurance/quality control and certification requirements for the State of California.

3.4.2 Soil Gas Sampling

A total of six soil gas samples will be collected in SUMMA™ cannisters in accordance with the *Bioventing Field Sampling Plan* (ES, 1992). The samples will be

FIGURE 3.3



NOT TO SCALE

FIRE TRAINING AREA
(FT - 002)
TYPICAL MONITORING POINT
CONSTRUCTION DETAIL

PLATTSBURGH AFB, NEW YORK

ENGINEERING-SCIENCE, INC.
Syracuse, New York

ES

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REVISED: 2/23/93

collected from the VW in Pit 1, from the VW in Pit 4, and from the VMPs closest to and furthest from the VW at each site. These soil gas samples will be used to predict potential air emissions, to determine the reduction in BTEX and total volatile hydrocarbons (TVH) during the 1-year test, and to detect any migration of these vapors from the source area.

Soil gas sample canisters will be placed in a small cooler and packed with foam pellets to prevent excessive movement during shipment. Samples will not be sent on ice to prevent condensation of hydrocarbons. A chain-of-custody form will be filled out, and the cooler will be shipped to the Air Toxics laboratory in Rancho Cordova, California for analysis.

3.5 Blower System

A 2.5-HP blower capable of injecting 30 - 90 scfm will be used to conduct the initial air permeability test at the two sites. This blower provides a wide range of flow rates and should develop sufficient pressure to move air through moderate permeability soils. Air injection will be used to provide oxygen to soil bacteria and to minimize emissions of volatiles to the atmosphere. If initial testing at either site indicates that less pressure is required to supply oxygen throughout the test volume, a smaller blower will be installed for extended testing.

An extended pilot test will be performed if initial pilot testing is positive. The extended bioventing test will be initiated following a review of initial test data and regulatory approval. Figure 3.4 is a schematic of a typical air injection system that will be used for pilot testing at these sites.

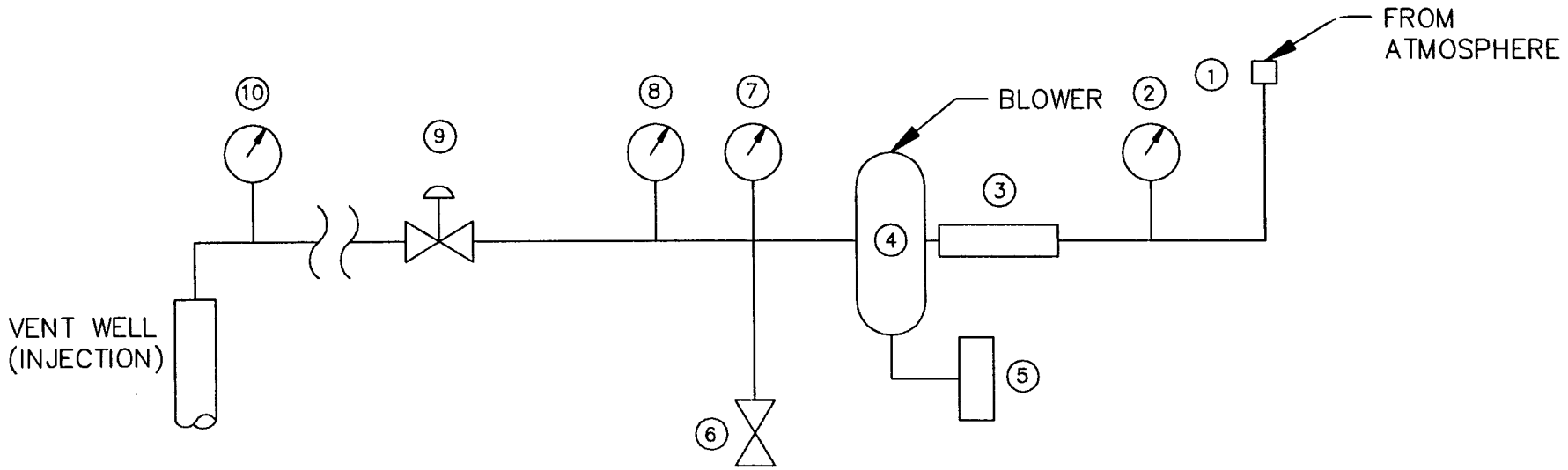
The maximum power requirement anticipated for this pilot test is a 230-volt, single-phase, 30-amp service. Additional details on power supply requirements are described in Section 5.0, Base Support Requirements.

3.6 Air Monitoring

The bioventing technique will minimize the loss of volatiles to the atmosphere by reducing air injection rates to the minimum required for oxygen supply for biodegradation. During air injection, the air will be monitored for volatile hydrocarbons at the soil surface and in the breathing zone to account for any volatilization that does occur and to ensure safe working conditions.

3.7 In Situ Respiration Test

The objective of the *in situ* respiration test is to determine the rate at which soil bacteria degrade petroleum hydrocarbons. Respiration tests will be performed at the three VMPs with the highest apparent fuel contamination at each site. Air will be injected into each VMP depth interval containing low levels (<2%) of oxygen. A 20 to 24-hour air injection period will be used to oxygenate local contaminated soil. At the end of the air injection period, the air supply will be cut off, and oxygen and carbon dioxide levels will be monitored for five days or until the oxygen level falls below 5 %, whichever is earlier. The decline in oxygen and increase in carbon dioxide concentrations over time will be used to estimate rates of bacterial degradation of fuel residuals. Helium will also be injected at all three points at each



1. INLET FILTER
2. VACUUM GAUGE – INCHES OF H20
3. DRIVE MOTOR
   2.5 HP / 3450 RPM @ 60 Hz / 230 v / SINGLE PHASE / 15 A /
4. BLOWER – GAST R5125
   145 SCFM @ 3450 RPM / REGENERATIVE
5. STARTER
   230 v / 27 A / SINGLE PHASE / H1036 HEATER (10.8 A)
6. AUTOMATIC PRESSURE RELIEF VALVE – SET @ 6 psig
7. PRESSURE GAUGE (INCHES OF H20)
8. THERMOMETER (FAHRENHEIT)
9. MANUAL PRESSURE RELIEF (BLEED) VALVE – 1 1/2" BALL
10. AIR VELOCITY MEASUREMENT PORT

SCHEMATIC OF BLOWER
SYSTEM FOR AIR INJECTION
FIRE TRAINING AREA (FT-002)
Plattsburgh AFB, New York

ENGINEERING-SCIENCE, INC.
Syracuse, New York
ES

FIGURE 3.4

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site to ensure that the VMPs do not leak and to estimate oxygen diffusion rates in site soils. Additional details on the *in situ* respiration test are found in Section 5.7 of the protocol document.

3.8 Air Permeability Test

The objective of the air permeability test is to determine the extent of the subsurface that can be oxygenated using one air injection VW. Air will be injected into the 4-inch-diameter VW using the blower unit, and pressure response will be measured at each VMP with differential pressure gauges to determine the region influenced by the unit. Oxygen will also be monitored in the VMPs to verify that oxygen levels in the soil increase as the result of air injection. One air permeability test lasting 4 to 8 hours will be performed.

3.9 Installation of Extended Pilot Test Bioventing System

Extended, 1-year bioventing pilot systems will also be installed at Pits 1 and 4. The base will be requested to provide a power pole with a 230-volt, single-phase, 30-amp breaker box. Two 115-volt receptacles will also be required. Depending on the availability of a base electrician, a base electrician or a licensed electrician subcontracted to ES will assist in wiring the blowers to line power. The blower will be housed in a small, prefabricated shed to provide protection from the weather.

The system will be in operation for 1 year, and at 6 months and 12-months of operation, ES personnel will conduct *in situ* respiration tests to monitor the long-term performance of this bioventing system. Weekly system checks will be performed by Plattsburg AFB personnel. If required, major maintenance of the blower unit may be performed by ES personnel. Detailed blower system information and a maintenance schedule will be included in the operation and maintenance (O&M) manual provided to the base. More detailed information regarding the test procedures can be found in the protocol document.

4.0 EXCEPTIONS TO PROTOCOL PROCEDURES

The procedures that will be used to measure the air permeability of the soil and *in situ* respiration rates are described in Sections 4 and 5 of the protocol document. No exceptions to this protocol are anticipated.

5.0 BASE SUPPORT REQUIREMENTS

5.1 Test Preparation

The following base support is needed prior to the arrival of a driller and the ES test team:

- Confirmation of regulatory approval for the pilot test.
- Assistance in obtaining a digging permit at each site.
- A breaker box or generator within 50 feet of the proposed VW which can supply 230-volt, single-phase, 30-amp service for the initial and extended pilot test. This service will be supplied from a central breaker box situated in the area of the fire training pits.

- Provision of any paperwork required to obtain gate passes and security badges for approximately four ES employees and two drillers. Vehicle passes will be needed for two trucks and a drill rig.

During the initial three week pilot test the following base support is needed:

- Twelve square feet of desk space and a telephone in a building located as near to the site as practical.
- The use of a fax machine for transmitting 15 to 20 pages of test results.

During the one year extended pilot test the following base support is needed:

- Check the blower system at FT-002 at least once a week to ensure that it is operating and to record the air injection pressure. Engineering-Science will provide a brief training session on this procedure.
- Notify Mr. Richard Moravec or Mr. David Brown, ES-Syracuse, (315) 451-9560; or Mr. Jerry Hansen of the AFCEE, (210) 536-5343, if the blower or motor stop working.
- Arrange site access for an ES technician to conduct *in situ* respiration tests approximately six months and one year after the initial pilot test.

6.0 PROJECT SCHEDULE

The following schedule is contingent upon timely approval of this pilot test work plan.

Event	Date
Draft Test Work Plan to AFCEE	Feb 1993
Submit Test Plan for Regulatory Approval	11 Mar 1993
Regulatory Approval To Proceed	25 Mar 1993
Begin Pilot Test	1 Apr 1993
Complete Initial Pilot Test	15 Apr 1993
Interim Results Report	5 May 1993
Respiration Test	Oct 1993
Final Respiration Test	Apr 1994

7.0 POINTS OF CONTACT

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Mr. Richard Moravec/Mr. Dave Brown
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Liverpool, New York 13088
(315) 451-9560 Fax.(315) 451-9570

8.0 REFERENCES

ABB Environmental Services, Inc. 1992. *FT-002 Soil Remedial Investigation Report, Draft Final, Plattsburg Air Force Base*. Plattsburg, New York. April.

Engineering-Science, Inc. 1992. *Project Management Plan for AFCEE Bioventing,* Appendix D, Field Sampling Plan. Denver, Colorado. April.

Hinchee, R.E., S.K. Ong, R.N. Miller, D.C. Downey, R. Frandt. 1992. *Test Plan and Technical Protocol for a Field Treatability Test for Bioventing.* Columbus, Ohio. January.

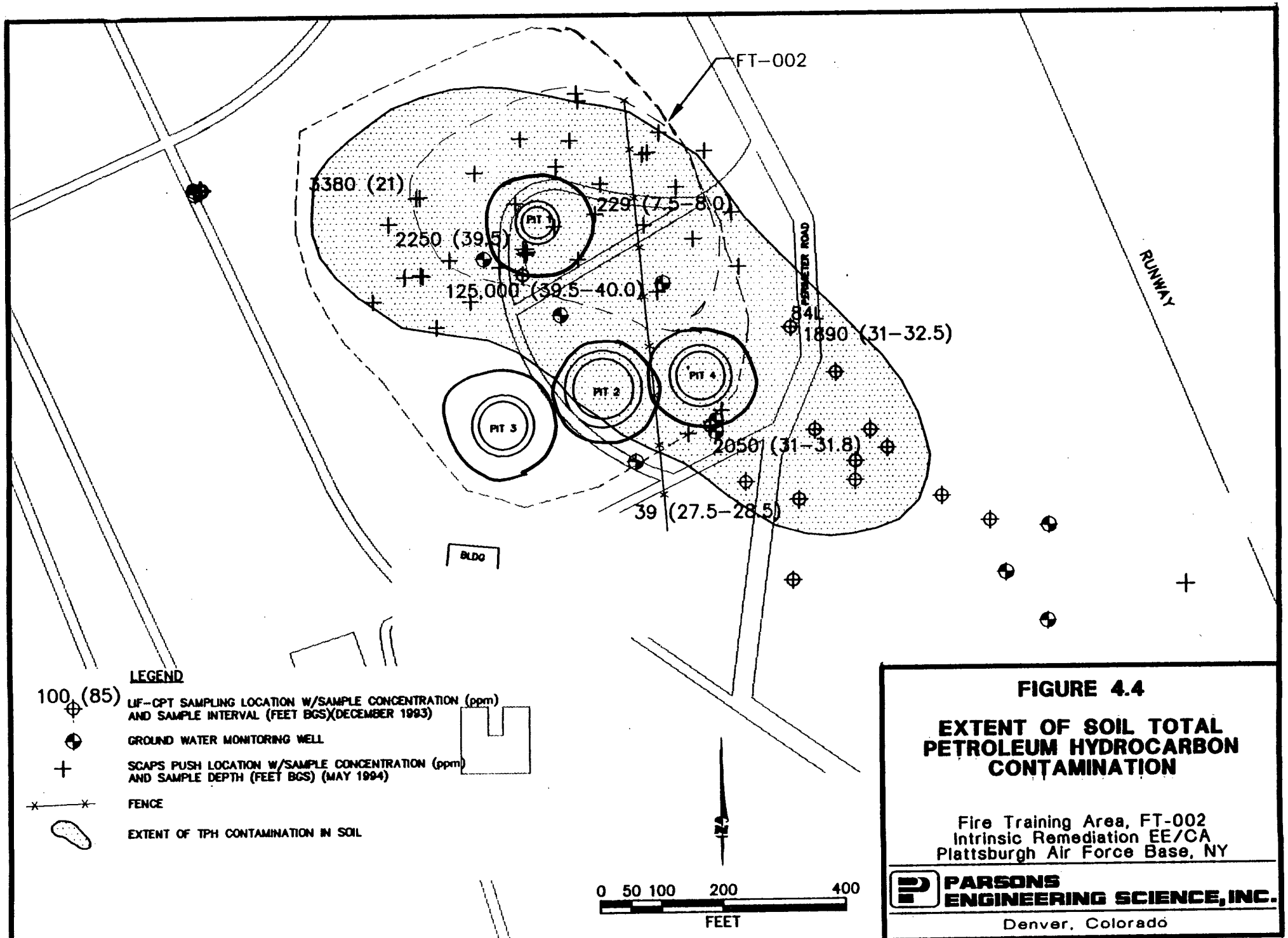
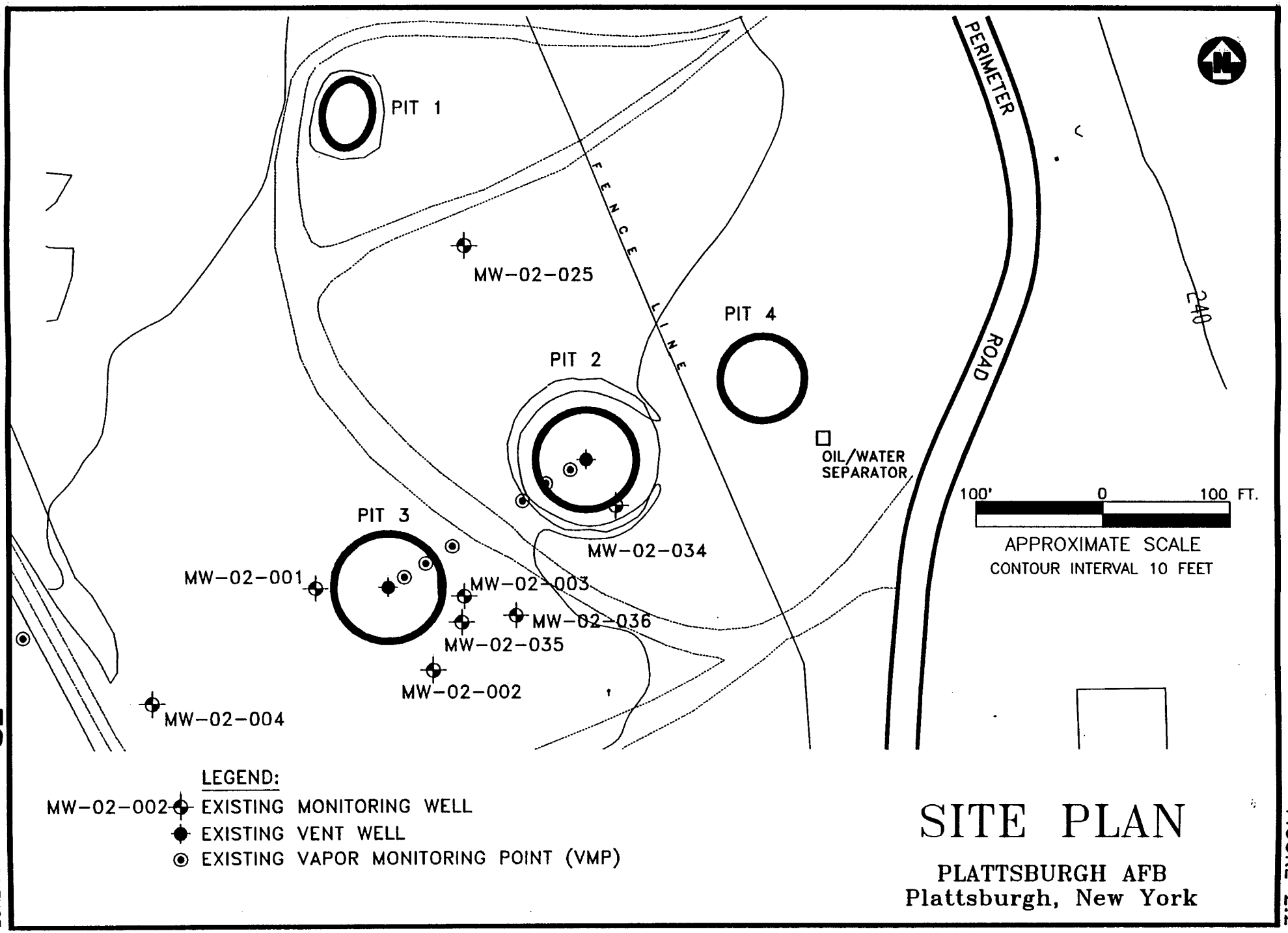


FIGURE 4.4

EXTENT OF SOIL TOTAL PETROLEUM HYDROCARBON CONTAMINATION

Fire Training Area, FT-002
Intrinsic Remediation EE/CA
Plattsburgh Air Force Base, NY

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado



SITE PLAN

PLATTSBURGH AFB
Plattsburgh, New York

FIGURE 2.2

ES ENGINEERING-SCIENCE

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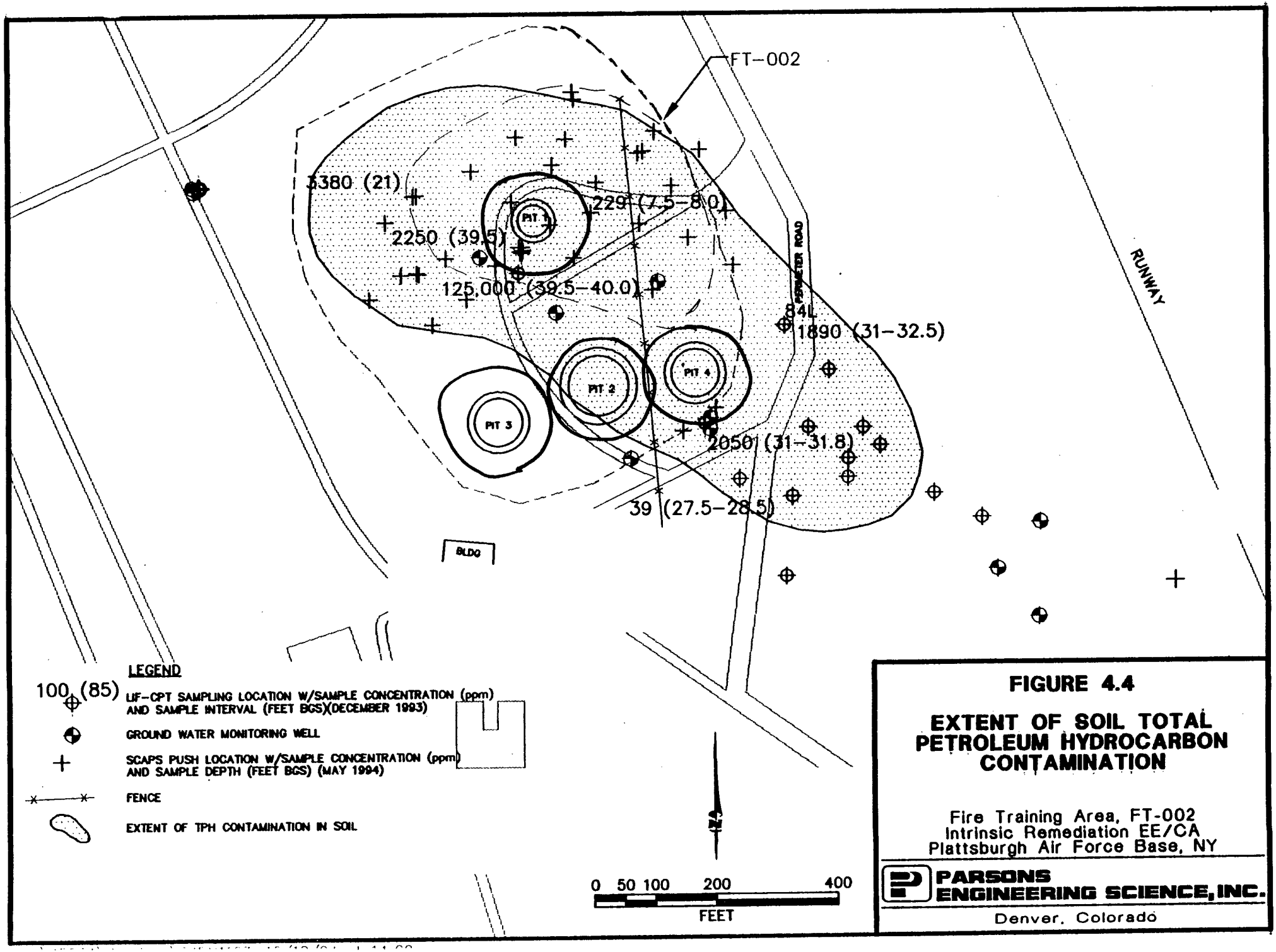

FIGURE 4.4

EXTENT OF SOIL TOTAL PETROLEUM HYDROCARBON CONTAMINATION

Fire Training Area, FT-002
Intrinsic Remediation EE/CA
Plattsburgh Air Force Base, NY

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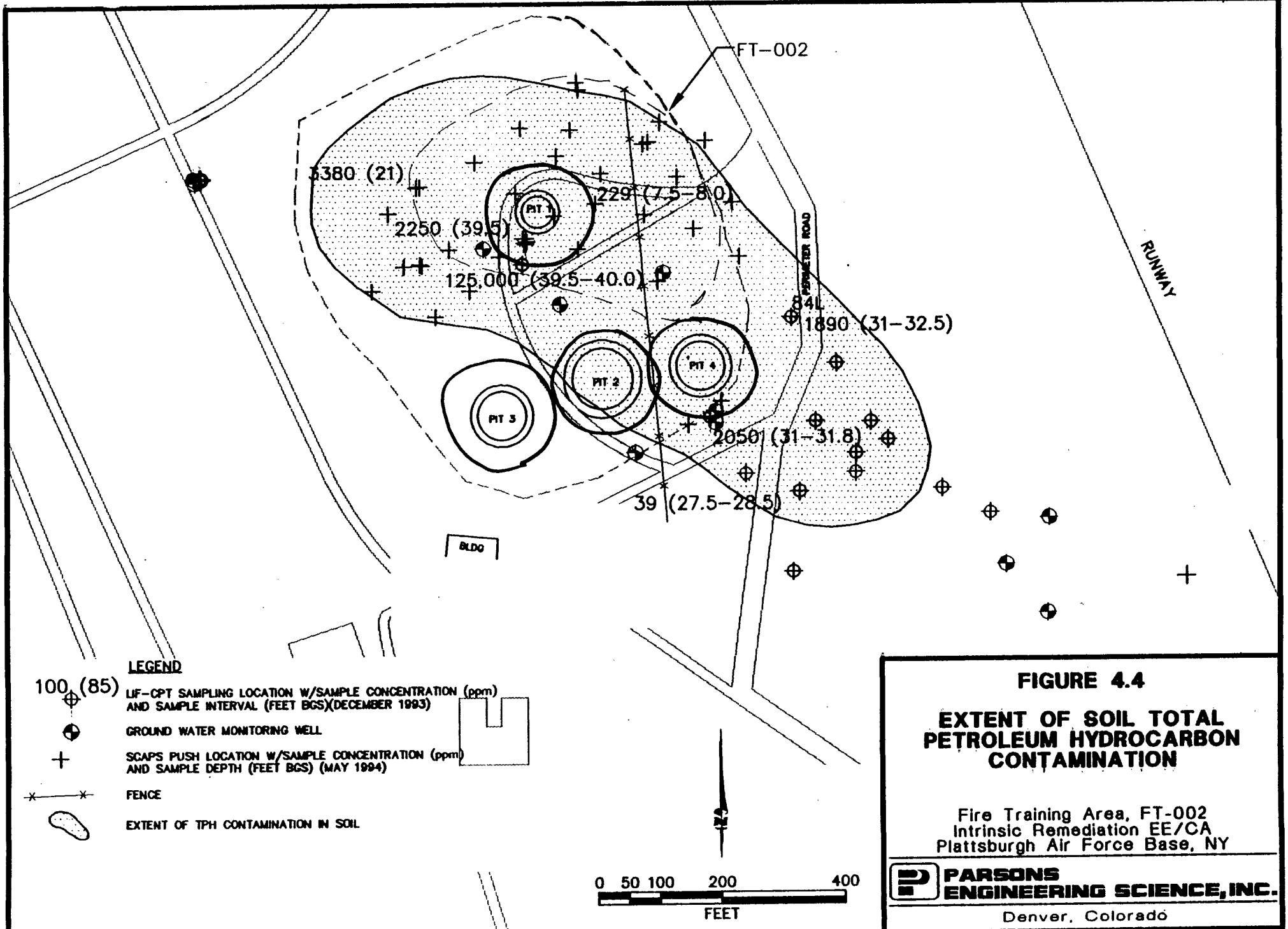

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